to be accommodated wholly or in part in other buildings; and years ago it was agreed on all hands that the needful accommodation should be provided on the west side of Exhibition Road, on the plot of ground between the Imperial Institute Road and the Natural History Museum.

This ground had been purchased by the Government in 1890, and sold by the Royal Commission for the Exhibition of 1851, at one-third its value, for the purpose of erecting scientific buildings on it.

But quite recently all this has been changed; the perfectly novel suggestion being made that a chemical and physical laboratory should be built on the *east* side of Exhibition Road on a part of the plot of vacant ground where it was proposed some years ago to erect buildings to complete the Art Museum. In fact, Mr. Webb's plans to cover all the vacant space with Art buildings were accepted.

Under the old and accepted arrangement we were to have Art, with power of expansion, on the east side, and Science, with power of expansion, on the west side, of Exhibition Road.

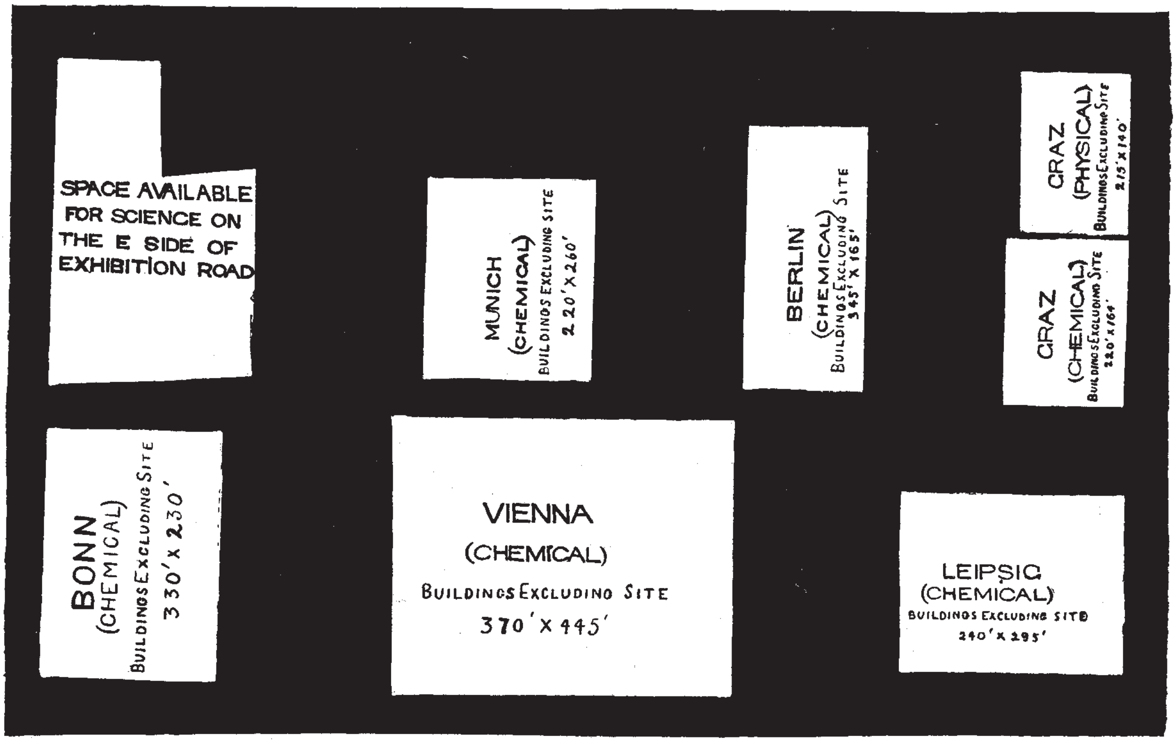
SPACE AVAILABLE FOR SCIENCE ON THE E SIDE OF EXHIBITION ROAD
MUNICH (CHEMICAL) BUILDINGS EXCLUDING SITE 220'X260'
BERLIN (CHEMICAL) BUILDINGS EXCLUDING SITE 345'X165'
GRAZ (PHYSICAL) BUILDINGS EXCLUDING SITE 215'X140'
GRAZ (CHEMICAL) BUILDINGS EXCLUDING SITE 220'X164'
BONN (CHEMICAL) BUILDINGS EXCLUDING SITE 330'X230'
VIENNA (CHEMICAL) BUILDINGS EXCLUDING SITE 370'X445'
LEIPSIG (CHEMICAL) BUILDINGS EXCLUDING SITE 240'X295'

FIG. 2.—Comparison of the space proposed to be devoted to the Chemical and Physical Laboratories at South Kensington, with the space devoted to similar buildings on the Continent.

Under the new proposal there would be no possibility of continuous and properly provided expansion of either. Adjacent Art buildings would strangle Science, and adjacent Science buildings would strangle Art. Hence the result would be disastrous for both, and it is on this ground that we now find the Royal Society and the Royal Academy shoulder to shoulder, and sending almost identical memorials to the Prime Minister.

The plan of the neighbourhood of the South Kensington and Natural History Museums (Fig. 1) shows, bounded by a black line, the space we may roughly take as available for the Science buildings on the vacant ground south of the existing Art Museum, on the assumption that this vacant ground is divided equally between Art and Science.

Fig. 2 shows the space thus available contrasted with the areas actually occupied by the buildings of certain continental Chemical and Physical Laboratories, *on the same scale*. It will be seen at once that London will be no better off than Graz!

We next turn to the land available on the west side of Exhibition Road. The plot which the Government has obtained from the '51 Exhibition Commissioners for a nominal sum for the purpose of the erection of Science buildings, is that bounded by the Imperial Institute, Exhibition and Cromwell Roads, and Queen's Gate. It contains 20 acres; of this more than 12 acres are allocated to the Natural History Museum. The remainder has to provide for the Inorganic Sciences, Mechanics, Physics and Chemistry in all their branches, and their teaching and applications to industry. It will be seen that the space is far too small for these needs, if the precedent set by the Natural History Museum is to be followed; and it must not be forgotten that in relation to Natural History there is no provision for teaching in the Museum, and from the nature of the subject no applications.

ASPECTS OF SUN WORSHIP AMONG THE MOKI INDIANS.[1]

THERE probably survives no tribe of Indians in the United States which has preserved its aboriginal worship in a purer form than the so-called Mokis, a group of agricultural people of north-eastern Arizona. These Indians live in seven villages or pueblos, situated on inaccessible mesas, and number a few less than 2000 souls. They inhabit the same territory, and in the case of the denizens of their largest pueblo, Oraibi, live on the same site that their ancestors did when visited by the early Spanish explorers, in the middle of the sixteenth century.

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[1] "The Winter Solstice Ceremony at Walpi." (*The American Anthropologist*, March–April 1898.)

For three hundred years after their discovery the Mokis were practically independent, and notwithstanding efforts were made by zealous priests to Christianise them during that time, these heroic attempts signally failed to change the aboriginal character of their religious beliefs and practices. With a pertinacity, born of conservatism, they still cling to their ancient mythology and ritual, which remains practically unmodified, presenting to the ethnologist a most instructive phase of native American religion.

An examination of this ritual shows it to be a most complicated one, as may be seen by a consultation of the extensive literature which has accumulated on this subject. Notwithstanding considerable progress has been made in the interpretation of many details, much still remains to be studied before accurate general ideas of its character are possible.

The Mokis are primarily agriculturists, and their religion is consequently one in which worship of the sun, rain, and growth of maize is pre-eminent.

The nature of their sun-worship is very obscurely known, notwithstanding it is well marked both in all great ceremonials from one end of the calendar to the other, and in many rites, which are limited to family life. Solar worship is especially prominent in the religious festivals which take place at the two equinoxes, and on the summer and winter solstices. Manifestly an adequate treatment of the subject of sun-worship among a people with whom it is so complicated, and all-pervading, would require a volume; and in a limited space I can hardly hope to do more than mention a few of many aspects of the subject.

The few lines which follow describe an aboriginal astronomical method of determination of the date of the winter solstice ceremony, and the dramatisation adopted in the performance of solar rites at that time. It is well known to students of the Moki ritual that the dates of the months on which the great ceremonials of their calendar are performed vary but little year by year, or that their religious festivals recur annually in the same months, and on or near the same days of the months. This precision would occasion little surprise, but for the fact that these Indians are, and always have been, ignorant of our almanacs, knowing nothing of our months, weeks or days.

The dates of their festivals, recurring year after year on the same, or nearly the same, days of the months, are determined by a method of great antiquity, probably pre-Columbian times. The native calendar of the Maya and kindred peoples of Central America are well known, and the accuracy with which the ceremonial and solar years were adjusted has been commented upon by several well-known Americanists. The Mokis had taken the most important step in the discovery of a similar calendar, for they are able to recognise the same day when it returns, year after year, by a purely astronomical method. To count the intervening days, or to determine the number of days in a ceremonial or solar year, was a secondary step which they never took, nor had they discovered that one festival follows another by a lapse of a certain interval of time.

The student who is interested in the question of the accuracy with which this same date was fixed upon year by year, will find in the *American Anthropologist* a tabular list of ceremonies and dates on which they occur. It will be seen from this list that while there is a variation of a few days in several important festivals, as the snake dance, in the case of those which take place at the winter solstice the method is perfect, and, as a result, the determination accurate to a day.

The dates for the celebration of the great ceremonies in their calendar are determined by the position of the sun on the horizon. The sun-lore, or astronomical knowledge necessary for this purpose, is traditional among men, called sun-priests, who belong to certain clans of the pueblo, and these clans are reputed to have migrated to Moki from ancestral homes in Southern Arizona, bringing this lore with them.

The time of year is determined by the place of the sun at sunrise or sunset, as seen from the roof of a particular house in the pueblo. Tne points on the horizon of sunrise and sunset, at the summer and winter solstices, are cardinal among these Indians, and they recognise that these directions have no relation to the polar north, or to one west, south and east. The four Moki cardinal points determine the orientation of their sacred rooms or kivas, and are connected with an elaborate world-quarter worship, to discuss which, in detail, would be out of place in this article.

Two of these points are called sun-houses. When the sun sets behind a certain notch in the horizon it descends into a so-called western sun-house which bears 50° south of west from the house of the sun-chief. This notch is made by a depression at the end of the Eldon Mesa, a spur of the San Francisco Mountains, appearing as a slight dent in the horizon silhouetted against the sky. It marks that point on the rim of the horizon south of which the sun never sets. The day on which the sun enters his western house he appears to stop in his southern course, as the word solstice signifies; and on the following day appears to retrace his steps, and set north of this point. Astronomically speaking, he is at the winter solstice.

In the same way a point on the eastern horizon marks the position of the sun when he halts in his northern course. This point marks the eastern sun-house from which the sun emerges at the summer solstice.

The peoples of the eastern and western horizons, as limited by the Moki cardinal points, is marked off by a number of intervals indicated by hillocks, trees, notches, or pinnacles. Each of these horizontal objects has a name known to sun-priests, who likewise know the particular days of the year which the conjunction of the sun, at sunrise or sunset, with these points indicate. Thus, when the sun rises from behind one of these hillocks the time for planting has come; or from a certain notch, the date of a great monthly festival is at hand. The sun-priest, who has determined the time by these solar horizontal observations, communicates the information to a town-crier, who announces it from the house-top in a voice audible throughout the pueblo. The native names of all these horizon points, and the corresponding ceremonials, are given in an account of the Tusayan Katcinas, published in the fifteenth Annual Report of the Bureau of American Ethnology.

It will thus be seen that with the Moki priests the position of the sun, rather than phases of the moon, is the primary method of assigning the dates to their great festivals; but there are certain ceremonials when the appearance of the moon likewise enters into the calculation.

The connection between the diminution of the lengths of the days, the cold winter, and the gradual withdrawal of the sun as each day it sets more and more to the south, has made a profound impression on the observant mind of the Mokis, and the fear naturally arose that the sun is about to desert them. As winter advances his rays become less powerful, and with equal pace a dread grows in the primitive mind that the sun will ultimately wholly abandon the distressed farmers. Special ceremonials arose out of this uncertainty. Means must be adopted to stay the sun's retreat, and rites were inaugurated for that purpose. These were founded on the belief that the sun is an anthropomorphic being who is liable to become feeble; he must be endowed with new life, and thus it comes about that one object of the winter solstice ceremony among the Mokis, as among some other races, is to recall the sun, to draw him back and recuperate his strength to fertilise the earth for successful crops.

For some reason, too profound for me to penetrate, these results are sought to be accomplished by an association of the worship of the sun with that of a plumed serpent. As with more cultured races, solar worship and ophiolatry are intimately associated both in the winter solstice ceremony and in similar weird rites which are performed at the vernal equinox immediately before planting time.

Great Serpent worship occurs in the winter solstice ceremony at Walpi, in the chief ceremonial chamber or kiva of that pueblo, on the night of December 20. At the western end of that room there is erected an altar, in the middle of which is an opening in which is placed a painted effigy of the head of the great serpent, made of a gourd. This effigy, which has a plumed head, is surrounded by artificial flowers made of small discs painted in different colours, and set in an upright framework forming a screen, which conceals one of the performers. A stack of maize is piled in front of this altar, and there are various paraphernalia of worship on the floor before it (Fig 1).

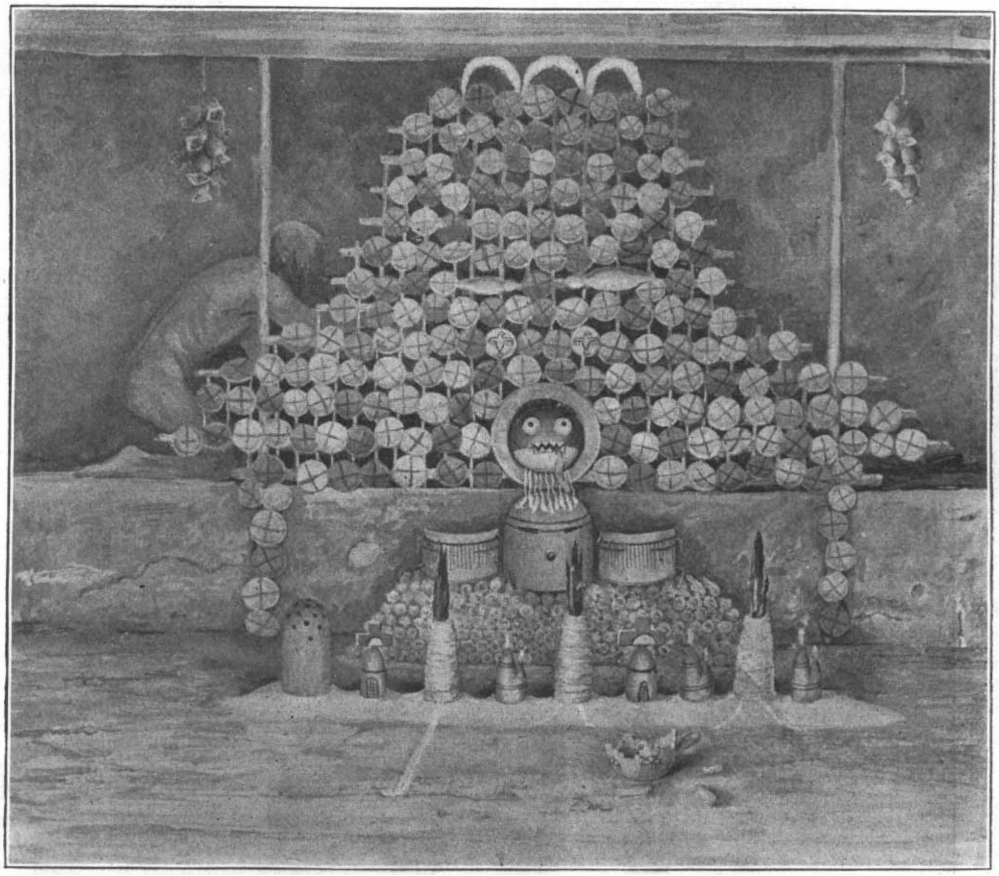

FIG. 1.—The Soyaluña Altar at Walpi.

During the singing of certain songs by the assembled priests, who are warriors, their chief advances to the altar, and sprinkles the snake effigy with sacred meal, at the same time saying a prayer to it.

The man concealed behind the bower or artificial flowers wags the head of the effigy, and blowing through a gourd produces several deep sounds imitating roars of the Great Serpent, in realistic responses to the prayers.

There are several objects sought in these prayers, one of which is that the Great Serpent will fertilise the maize before the altar. It would seem that, in their opinion, the ceremony was efficacious for this purpose, for on the morning following this rite, this maize is distributed among the women of the pueblo, to serve as seed at the next planting.

In a great annual festival at the vernal equinox, we have an even closer connection of sun and serpent worship. At that time a curtain is hung from the rafters of the same room, and this curtain or screen is pierced by a row of six holes, four of which are closed by circular flaps on which sun symbols are painted. These flaps hang by hinges from the upper rim of the orifices, and open towards the spectators. Before this screen, on the floor of the room, there is arranged a miniature field of maize composed of rectangularly arranged hillocks of soil in which sprouted seeds have been inserted. Several men stand behind the screen, and while songs are sung by a chorus, they thrust the heads of effigies of the Great Serpent through the holes in the curtain, raising the flaps decorated with sun emblems. As these monster heads protrude from the screen, a man, personating an earth goddess, passes from one effigy to another holding sacred meat to their mouths for food, and offering their artificially made breasts for nourishment.

Of the several other rites performed before the winter solstice altar, none are more instructive to the student of

Moki sun-worship than the following. Shortly after the ceremonies mentioned above, a number of men, bearing shields with appropriate totems, arrange themselves in two clusters, one on each side of the room, and in their midst stands a performer representing the sun, also bearing a sun-shield (Fig. 2). At a signal the participants, with shields adorned with their totems, engaged in a mimic combat, surging against each other with wild shouting and rhythmic stamping on the floor. This combat is a dramatic representation of the assault of hostile gods on the personator of the sun, who is ultimately victorious over his opponents. It vividly suggests certain Mexican ceremonies performed at the vernal equinox before an idol, Totec (a solar god), save that in the sanguinary Aztec rites men representing hostile gods were sacrificed to recuperate the sun. This episode in the Mexican ceremony is thus referred to by Mr. E. J. Payne in his valuable work on the "History of America." "The victims of the festival, attired like the various deities whom they represented, were conducted to one of those enclosed courts open to the sky, which have been mentioned; here a gladiatorial stone and an altar, elevated on a low platform, stood side by side. Each victim was first placed on the temalacatl and compelled to engage in an imitation of the gladiatorial combat. . . ." On receiving the first wound, he was sacrificed on the solar altar.

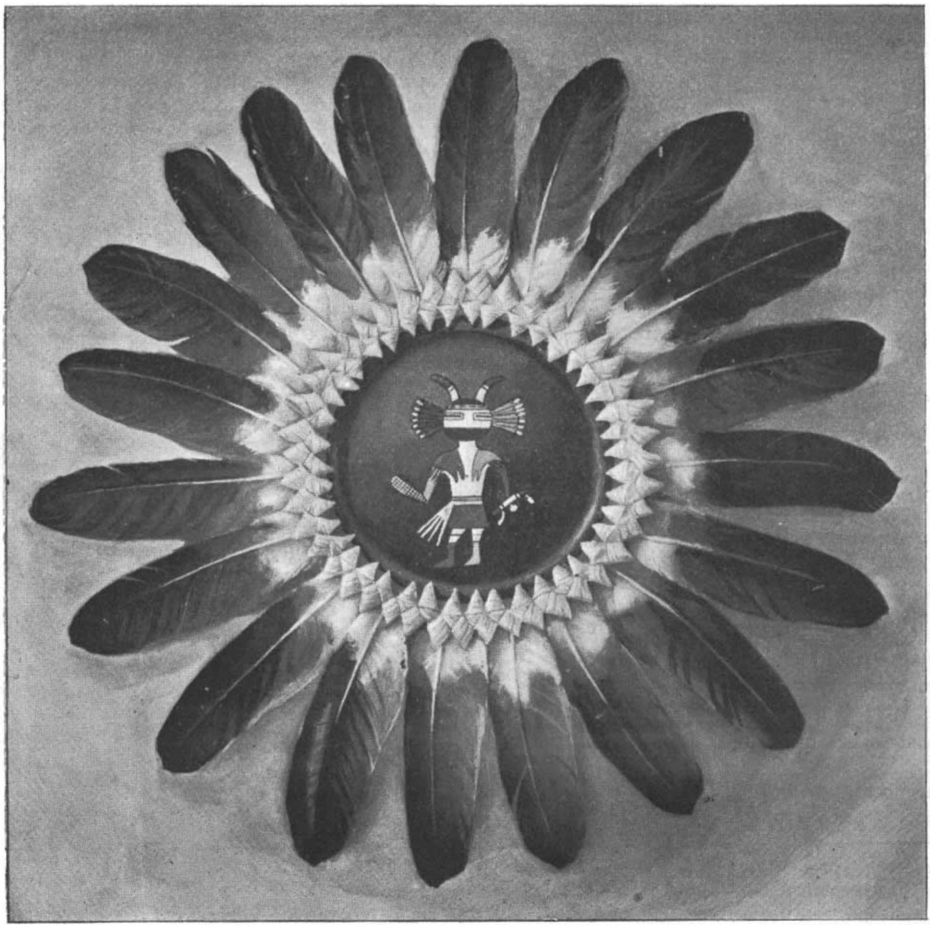

FIG. 2.—Sun Shield of the Horn Society.

In the winter solstice sun-worship among the Mokis there is no such sanguinary outcome to their mimic combat of warriors, for human sacrifice is unknown to them, except in legends. The dramatic combat in the ceremonial room before the altar of the Great Serpent is a bloodless one, but its object is not greatly different from the Mexican variant, viz. to recuperate and draw back the sun by the defeat of hostile powers represented by dramatisation in the sacred room of the pueblo.

J. W. F.

CLOSING OF THE BEN NEVIS OBSERVATORIES.

WE have received for publication the following extract from the Report of the Scottish Meteorological Society. It is to be hoped some means will be found of keeping the Observatories going.

"The Directors greatly regret to have to announce that the High and the Low-level Observatories at Ben Nevis will cease to exist in October of this year. This is the necessary outcome of the want of funds. There is no way, so far as the Directors can see, by which these great first-class Meteorological Observatories can be continued, except by aid from the State. In other words, the Directors have no grounds for expecting that further assistance will come from private sources."

"This decision has been come to in consequence of estimates submitted by the Honorary Treasurer, from which it appears that if, in October next, the property belonging to the Directors were realised and all obliga-